TradeRES

New Markets Design & Models for 100% Renewable Power Systems

D2.1 Database of TradeRES scenarios

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Author(s) information (alphabetical)		
Name	Organisation	Email
Niina Helistö	VTT	niina.helisto@vtt.fi
Juha Kiviluoma	VTT	juha.kiviluoma@vtt.fi
Lassi Similä	VTT	
Kristina Nienhaus	DLR	
Ricardo Hernandez Serna	TNO	
Silke Johanndeiter	ENBW	

Acknowledgements/Contributions		
Name	Organisation	Email
Nikolaos Chrysanthopoulos	Imperial	n.chrysanthopoulos@imperial.ac.uk
António Couto	LNEG	antonio.couto@lneg.pt

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Version	Date	Dissemination Level	Description		
2.0	17.11.2022	PU	Common data on policy scenarios, emission and commodity prices, forecasted technological progress, RES potentials, and other related parameters.		
			Prepared by	Reviewed by	Approved by
			Niina Helistö, J. Kiviluoma, L. Similä, K. Nienhaus, R. Hernandez Serna, S. Johanndeiter	Milos Cvetkovic	A. Estanqueiro

Executive Summary

The present deliverable, as part of task 2.1, includes common data on policy scenarios; emission prices; commodity prices; projected cost and technical parameters of energy conversion technologies and transmission connections; biomass, wind and solar potential; as well as initial generation and transmission capacities in the scenarios.

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1. Scenarios

The four coloured cells in Table 1 produce four central scenarios based on 100 % RES (or near). Time is irrelevant in the context of these scenarios (if this RES level happens in 2030, 2040, 2050, or 2060 etc.).

Additional variations on weather years, cost developments, etc. can be built as sensitivity cases. Similarly, when in the following sheets data is given for low, medium, and high assumptions, or several years, then these can be studied as sensitivity cases. In addition, the modelling may start from low CO_2 price and 2030 technology cost and biomass potential assumptions, but if those do not lead to a near 100 % low-carbon electricity system, assumptions can be changed relatively easily, and it is also possible to force a certain share of low-carbon generation in the investment phase.

TradeRES scenarios used fixed transmission capacities from external scenarios, but generation capacity was decided in the investment phase of the model. There was remaining fossil fuel generation capacity, but their use was limited with a constraint.

Some of the case studies can also build an additional ~60 % scenario to prove robustness, workability, and the pathway towards 100 % RES. This 'S0' scenario was created by forcing low-carbon generation to be ~60% across the model geographical scope.

Table 1 Scenarios for electricity (and energy) system optimization models and pricing

High flexibility of demand: Much flexible demand from direct and indirect electrification of industry/mobility/heating	**S2 ("VRE-flex+"):** - Some fossil-based thermal power capacity - High electrification, therefore many new electricity loads that are flexible - Thermal power and demand can set the electricity price	**S4 ("VRE+flex+"):** - almost no fossil-based thermal capacity - High electrification - Many new, flexible electricity loads due to electrification - Electricity price based only on demand
Low flexibility of demand: Little flexible demand from direct and indirect electrification of industry/mobility/heating	**S1 ("VRE-flex-"):** - Some thermal power capacity - High electrification, therefore many new electricity loads, yet not that flexible - Thermal power can set the electricity price	**S3 ("VRE+flex-"):** - almost no thermal capacity and H2 turbines and nuclear - High electrification, therefore many new electricity loads, yet not that flexible - unvoluntary load shedding and curtailment - Electricity price based on renewables and unvoluntary load shedding
	85% renewables	95% renewables

Note: Thermal capacity refers to thermal electricity-generation capacity.

2. Common data on scenarios

The common data on the scenarios are given in the supplementary data file. Table 2 describes the data items that are included in the data file.

Table 2 Description of data items in the scenario data file

	Description
Emission prices	Price alternatives (low, medium, high) for emissions
Commodity prices	Price alternatives (low, medium, high) for commodities
New technology data	Projected cost and technical parameters of new energy conversion (production, consumption, storage) technologies
New transmission data	Projected cost and technical parameters of new connections (transmission lines etc.)
Biomass potential	Biomass potential in European countries
Wind potential	Wind (offshore and onshore) potential in European countries
Solar potential	Solar (different PV categories and CSP) potential in European countries
Transmission capacities	"Initial" transmission capacities in the scenarios
Generation capacities	"Initial" generation capacities in the scenarios

3. Supplementary data

The actual deliverable is the TradeRES_D2_1_Scenario_data_v2.xlsx, which holds the original data for the different scenarios. These assumptions have then been taken to model specific input data files. For Backbone these include (and are available for the consortium in the T2.3 Sharepoint folders):

- TradeRES_base_data.xlsx (base system without new flexibilities)
- TradeRES_H2_data.xlsx (industrial hydrogen demand as a flexibility)
- TradeRES_EV_data.xlsx (electric vehicles as additional demand and flexibility)
- TradeRES_building_data.sqlite (replacing electricity demand from space heating with partially flexible options based on building envelope, heat storages and parallel heaters)

These files can be read into Spine Toolbox database serving Backbone model using the Spine Toolbox project available in https://github.com/TradeRES/TradeRES-Backbone-demo. The files contain scenarios and can be executed also for the case study countries

separately. All of the files follow the data definitions used by Backbone and the data format is introduced in the D2.3.

For COMPETES the model specific input files are with TNO, as they contain also confidential input data.